APPENDIX A

Glossary of Terms

GLOSSARY OF TERMS

1% Flood	Also called 100 Year flood or 100 year event - Refers to a flood of a magnitude that has an estimated probability of 1 in 100 of occurring in any given year. Technically more precise way of referring to the "100-year flood". Generally, 1%, 2%, 10% events refer to levels of flood flows with an expected recurrence of 100, 50, and 10 years respectively.
200 year event	Flood flow with an expected recurrence of 200 years
500 year event	Flood flow with an expected recurrence of 500 years
Active channel	See bankfull channel
Algae	Microscopic plants which contain chlorophyll and float or suspend in water. Excess algae growths can impact tastes and odors to potable water. Their biological activities affect the pH and dissolved oxygen of the water.
Algae mat	Blanket of algae. See algae
Amplitude	See meander amplitude
Anaerobic	Without oxygen. See dissolved oxygen
Aquifer	An underground geologic formation of rock, soil or sediment that is saturated with water; an aquifer stores groundwater.
Bankfull channel	The stream channel that is formed by the dominant discharge, also referred to as the active channel, which meanders across the floodplain as it forms pools, riffles, and point bars.
Belt width	See meander belt width
Biological	Of or relating to biology. See biology.
Biology	The science of living organisms and life processes, including the study of structure, functioning, growth, origin, evolution, and distribution of living organisms. The animal and plant life of a region or place.
Biota	Plant and animal life of a region.
Biotechnical	Soil bioengineering – also referred to as biotechnical slope protection. Involves the use of live and dead woody cuttings and poles or posts collected from native plants to re-vegetate watershed slopes and stream banks. The cuttings, posts, and vegetative systems composed of bundles layers, and mats of the cuttings and posts provide structure, drains, and vegetative cover to repair eroding and slumping slopes.

Bypass	A facility through which a portion of a stream's flow is diverted from one point and reintroduced into the stream at the downstream end of the bypass channel. Bypass channels can be used during the construction or maintenance process. Permanent bypass channels can also be designed to accommodate flood flows.
Channel Reach Characteristic	Measurable characteristics of a portion (reach) of a channel such as the slope of the channel, the slope of the land or valley through which the channel flows, the confinement of the channel and the entrenchment of the channel.
Community benefits	Refers to the range of community benefits beyond flood protection that might be integrated into a creek project. These include safety, recreation, education, aesthetics, open space, economic benefits, cultural benefits, efficient use of resources, and other community desires. Individual communities may define their own desires on a project-specific basis.
Corps	United States Army Corps of Engineers
Creation	Action taken by the District to convert upland environments or environments otherwise devoid of vegetation, into modified upland, wetland or other aquatic habitat for purposes of meeting mitigation obligations or enhancement objectives.
Design flow/ design event	The magnitude of stream flow that is used in design of channel improvements and structures in the vicinity of channels.
Developed areas	Urban areas; areas where structures or constructed improvements are present
Discharge	The volume of water passing through a channel during a given time period, usually measured in cubic feet per second.
District Board of Directors	The Santa Clara Valley Water District Board of Directors is composed of Seven members. Five members are elected from geographic areas which coincide with the county supervisorial districts, and two at-large members are appointed by the county Board of Supervisors. The Directors serve overlapping four-year terms. This structure was created pursuant to the adoption of the District Act. The Board establishes policy on the District's mission, goals, and operations. It represents the general public in deciding issues related to water supply and flood protection. The Board also has the authority to adopt ordinances that have the force of law within the District.
District Policy 3-410	Flood Control Maintenance Road Criteria: Construction and maintenance of flood control facilities require adequate access for heavy equipment and vehicles. Maintenance roads for channels must be coordinated with public trafficways and must provide continuous access to and along all areas under District responsibility. Roadway width must be sufficient to allow equipment travel and operation at all points along the channel. The

	number and width of flood control access roads vary with the size and design of channel. District experience indicates that the following minimum criteria for maintenance access roads is required. NUMBER OF MAINTENANCE ROADS: Concrete-lined Channels – one (either side). Earth channels (25ft or less in width) – one. Earth channel (greater than 25ft wide) – two (one on each side). WIDTHS OF MAINTENANCE ROADS (EXCLUSIVE OF DRAINAGE DITCH): Maintenance roads at grade or depressed (channel less than 40ft in width) – 15 feet clear width. Maintenance roads at grade or depressed (channel width more than 40 feet) – 18 feet clear width. Maintenance roads elevated (minor channels) – 18 feet clear width. Maintenance roads elevated (major channels) – 21 feet clear width. EQUIPMENT SWING WIDTHS: Channel 30 feet or less in width – 15 feet. Channel over 30 but less than 40 feet in width – 18 feet. Channel 40 feet or more in width – 22 feet. The channel width used in the delineation of numbers of roads and their widths is defined at the elevation of the maintenance road. The maintenance road widths are expressed in clear widths unencumbered by landscaping and fences. The equipment that uses these maintenance roads requires swing room for operation as indicated; these swing widths include the maintenance road and can include adjacent low shrub landscaping but must be clear of trees or tall fences. Where the points of access to maintenance roads along the channels are more than 1,000 feet apart, passing areas of at least 25 feet clear width will be provided about 500 to 800 feet apart. Where the maintenance road dead-ends and no acess to the road is available, turnarounds of at least 30 feet outside of and adjacent to the maintenance road will be provided.
District's Mission	The Mission of the district is a healthy, safe and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective and environmentally sensitive manner.
Dissolved oxygen	The oxygen dissolved in water. It is necessary for aquatic life. **(**D.O) Amount of free oxygen found in water. Low D.O. levels adversely affect fish and other aquatic life. The ideal dissolved oxygen for fish life is between 7 and 9 mg/L; most fish cannot survive when the DO level falls below 3 mg/L.
Dominant (hydraulic and sediment) discharge	Bankfull discharge – channel forming discharge – dominant discharge – the channel forming discharge responsible for the active channel that over a period of time carries the most sediment. The discharge, in terms of flood frequency, usually has a return period or recurrence interval of 1.5 to 2 years in natural channels. This represents a flow condition where the stream flow completely fills the active channel. Also referred to as effective discharge.
Dynamically stable	Dynamic equilibrium – although stream corridors display consistent patterns in their structure, processes, and functions, these patterns change naturally and constantly, even in the absence of human

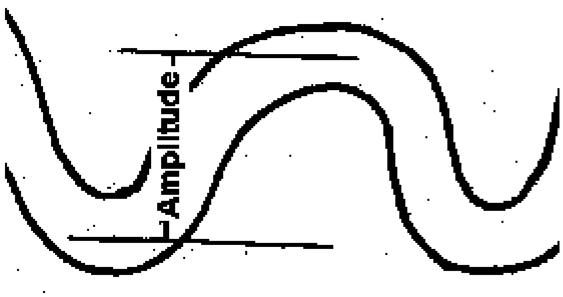
	disturbance. Despite frequent change, streams and their corridors exhibit a dynamic form of stability. In constantly changing ecosystems like stream corridors, stability is the ability of a system to persist within a range of conditions. This phenomenon is referred to as dynamic equilibrium.
Ecology	The study of the interrelated biology of plants and animals, terrestrial and aquatic with emphasis on natives. The relationship between organisms and their environment.
Endangered species	The most severe listing under the Federal Endangered Species Act or California Endangered Species Act. The term "endangered species" means any species which is in danger of extinction throughout all or a significant portion of its range (Definition from the Federal Endangered Species Act).
Endemic species	A plant or animal species that is native, confined to, or limited to a certain region.
Engineering and Policies Procedures	Manual containing all of the (previously official) District engineering policies and procedures. Separated into 5 different sections: 1. District General. 2. Water Utility. 3. Flood Control. 4. Miscellaneous. 5. Drafting Standards.
Enhancement (Environmental)	Action taken by the District that benefits the environment, is NOT mitigation, and is undertaken voluntarily. Enhancement actions may include environmental restoration, rehabilitation, preservation or creation; in instances where located in the same vicinity as a mitigation project, actions must exceed required compliance to compensate for environmental impacts.
Erosion	The detachment of soil particles.
FEMA	Federal Emergency Management Agency. Has authority over federal flood insurance program and publishes the 100-year flood map through the National Flood Insurance Program.
Fish ladder	Artificial, stepped pools to enable fish traveling upstream, against the flow of water, to span a large vertical distance in a series of gradual steps. Used at dams or other in-stream barriers.
Fixed bed	A stream channel that has been designed to convey water without movement of the streambed. Generally refers to concrete-lined channels or other hardscape such as articulated concrete mattress, gabions or sacked concrete.
Flood conveyance channel	A channel, modified or natural, that conveys high flows of rainfall runoff through an area.

Flood damage	Damage that occurs from high flows – damage could occur within the channel in the form of erosion or damage to instream or near stream structures; or outside the channel when flows overbank, putting life and property at risk from water, sediment or debris.
Floodplain	A highly variable area on one or both sides of the stream channel that is inundated by floodwaters at some interval, from frequent to rare. For example, the potential floodplain adjacent to the active, or bankfull, channel may be inundated once every year or two. The one percent floodplain has a one percent chance of being entirely inundated in any given year.
Floodwall(s)	A wall constructed adjoining a channel to prevent flooding of the surrounding areas.
Fluvial	Of, relating to, or originating in a stream or river.
Freeboard	Vertical distance between the top of an embankment adjoining a channel and the water level in the channel.
Geomorphology	The study of surface forms of the earth and the processes that developed those forms. The hydrologic processes drive the geomorphic processes. In turn, the geomorphic processes are the primary mechanisms for forming the drainage, patterns, channel, floodplain, terraces, and other watershed and stream corridor features. Three primary geomorphic processes are involved with flowing water, as follows: Erosion, the detachment of soil particles. Sediment transport, the movement of eroded soil particles in flowing water. Sediment deposition, settling of eroded soil particles to the bottom of a water body or left behind as water leaves. Sediment deposition can be transitory, as in a stream channel from one storm to another, or more or less permanent, as in a larger reservoir.
Geotechnical	Relationship between structures and the ground. Uses the science of soil mechanics, such as geology, soil properties, stresses in soils, failures, consolidation and settlement, subsidence, compaction, soil improvement and slope stability
Grade control structures	Instream structures used to provide stability to the streambed (channel bottom). They help to prevent channel degradation (downcutting) and stabilize the channel. One type of grade control provides hard protection on the streambed that is capable of resisting erosive forces. Other types of grade control include drop structures, weirs, check dams, and bed sills.
Green construction	Construction practices that minimize use of resources and/or capitalize on natural systems to provide desired results, such as using recycled materials, solar power, passive heating and cooling

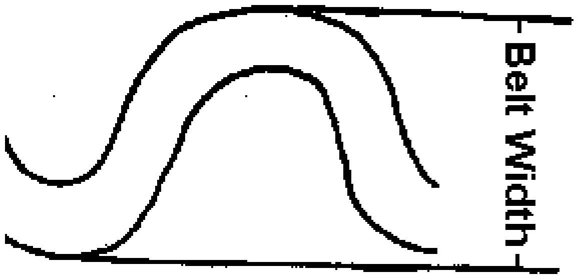
Groundwater	Water that has percolated into natural, underground aquifers
Groundwater recharge	The process of infiltration and percolation of water from land areas or streams through permeable soils into the aquifer.
Habitat	The specific area or environment in which a particular type of plant or animal lives. To be complete, an organism's habitat must provide all of the basic requirements of life for that organism.
Habitat mosaic	A collection of habitat patches, none of which are dominant enough to be interconnected throughout the landscape.
Hardscape	Hard structures: A type of bank protection structure incorporating rock, riprap, sack concrete, gabion baskets and mattresses, or concrete. These structures are inert and rigid.
High-flow events	The occurrence of higher-than-normal flow in creeks and flood conveyance systems
Holistic	Concerned with the whole rather than with piecemeal analysis or dissection into parts.
Hydraulic control structure	Instream structure used to regulate the natural flow through a channel. Can be used to divert, restrict, or stop the flow and could help control headwater and tailwater elevations as well as reducing erosion. Different types of hydraulic control structures include: pumps, dams, gates, gated spillways, baffles, drop structures, weirs, etc.
Hydraulic shear	Hydraulic force parallel to a surface as opposed to directly on the surface. An example of shear would be the tractive force that removes particles from a stream bank as flow moves over the surface of the slope.
Hydraulics	The physical science and technology of the static and dynamic behavior of fluids.
Hydrology	The science of the waters of the Earth, their occurrence, circulation, and distribution, their chemical and physical properties, and their reaction with their environment, including their relation to living things. Related to the hydrologic cycle – describes the continuum of the transfer of water from precipitation to surface water and ground water, to storage and runoff, and to the eventual return to the atmosphere by transpiration and evaporation.
Hydrophilic exotic landscaping	Non-native plants that require much more water than is naturally available (thus requiring constant irrigation).
Incised channel	A stream that has degraded and cut its bed into the valley bottom. Often indicates accelerated and destructive erosion. Channels in the Santa Clara Valley are often naturally incised, due to natural geology and historic changes in rainfall quantities and sea level.

Integrated floodplain corridor	(Transitional Upland Fringe – a portion of the upland on one or both sides of the floodplain that serves as a transitional zone or edge between the floodplain and the surrounding landscape. Stream Corridor Restoration – pg1-12.
Letter of Map Revision	A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations, and planimetric features.
Levee	A constructed embankment usually of earth, used to prevent a river from overflowing. Natural levees do occur in Santa Clara Valley, where the overbanking floodwaters drop a significant portion of their sediment load immediately upon leaving the channel, building up over time a discernible levee.
Life cycle costs	Life cycle costs – examines project costs as a long term investment rather than a one-time cost. Is analyzed with three components – capital costs, maintenance or operations costs, and opportunities to reduce either of those costs through grant or cost-sharing opportunities.
Local drain systems	Refers to the stormwater collection and release system managed by a local agency (city, town, etc.). These are often sub-grade storm pipes and are often designed to convey the 3 to 5-year storm event to the local creek.
Local partner agencies	Refers to cities, towns, the County, etc. that would be affected by and therefore have an interest in, the planning and design of river projects. Does not refer to regulatory agencies.
Maintenance	The activities necessary to ensure that the elements of a project continue to operate properly after construction. In the habitat restoration context, includes activities that ensure the successful establishment of restoration plantings, including, but not necessarily limited to, weeding, thinning, irrigation, and exotic species control.
Meander	The naturally-occurring curve in the planform of a stream channel. Natural meanders tend to form a generally predictable repeating pattern where stream curves along a consistently-sloped valley tend to be of like size in length and breadth. The following diagram depicts the different aspects of meanders. Described in detail in “Applied River Morphology”, Dave Rosgen, page 2-6. Has a good diagram with wave length and belt width, but doesn’t have a clear definition. Page 4-9 has ex. of stream types.

Meander amplitude See diagram.

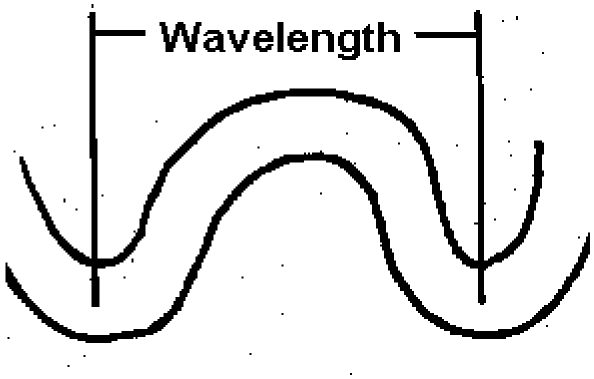


Meander belt width See diagram.



Meander length See diagram.

Meander Wavelength See diagram



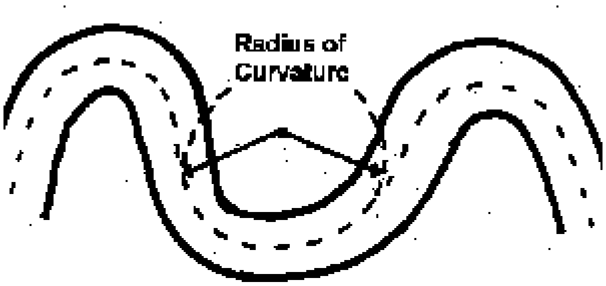
Memorandum of Consensus A signed agreement by local government agencies and other local stakeholders to work together in exploring solutions/alternatives to the concerns and issues at hand.

Memorandum of Understanding (MOU) A formal document that states the intentions and/or responsibilities of the signatory parties.

Mitigate To moderate, reduce, or alleviate the impacts of a proposed activity. May include: (a) avoiding the impact by not taking a certain action; (b) minimizing the impact by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and/or (e) compensating for the impact by replacing or providing.

Mitigation	Action taken by the District to fulfill CEQA/NEPA, permit requirements and court mandated mitigation to avoid, minimize, rectify or reduce adverse environmental impacts, or compensate for the impact(s) by replacing or providing substitute resources or environments.
Natural flood protection	A multiple-objective approach to providing environmental quality, community benefit and protection from creek flooding in a cost effective manner through integrated planning and management that considers the physical, hydrologic and ecologic functions and processes of streams within the community setting.
Natural resource	A material source of wealth, as timber, fresh water, or a mineral deposit, occurring in a natural state.
"No Project" alternative	The existing condition, with no new structural or nonstructural modifications. The project baseline condition. The expected future condition if no action is taken (not necessarily the same as the present condition)
Nonpoint source (of pollution)	Pollution that comes from diffuse sources such as urban and agricultural runoff. A contributing factor to water pollution that cannot be traced to a specific spot. Pollution which comes from diffuse sources such as urban and agricultural runoff. Major nonpoint sources of pollution include excess farm and lawn nutrients that move through the soil into the ground water or enter local water directly through runoff during heavy rains; uncontrolled storm water runoff from construction sites; forestry operations; animal wastes; and even pollutants released directly into the atmosphere.
Nuisance flooding	Flooding that is not likely to cause damage or risk to health or safety; one guideline defines it as slow-moving water of one-half foot or less.
Offstream detention	A water storage facility used to temporarily store water during a major storm event, the facility is located away from the creek itself.
Permitting requirements	There are a number of state and federal laws and regulations to protect the environment. These laws and regulations are often enforced by requiring specified government agencies to issue a permit prior to work in environmentally sensitive areas. The District regularly is required to obtain permits from the U.S. Army Corps or Engineers, U.S. Fish and Wildlife Service, NOAA Fisheries, Regional Water Quality Control Board, and the California Department of Fish and Game. Each permit gives the permitting agency an opportunity to attach specific measures to the project to reduce the impact to the environment.

Pool	A location in an active stream channel, often on the outside of meander bends, where the water is deepest and current velocities are low.
Point bar	A bank on the inside of a meander bend that has built up due to sediment deposition, often opposite a pool. Bar – a sand or gravel deposit found on the bed of a stream that is often exposed during low water periods.
Potable water	Water that is fit to drink.
Planform	The planimetric view, or the view from above. The planimetric view of various stream patterns, which may be qualitatively described as straight, meandering, or braided forms, will also exhibit specific geometric relationships that may be quantitatively defined through measurements of **meander wavelength, radius of curvature, amplitude, and belt width.**
Preservation	Action taken by the District to protect an ecosystem or habitat area for compatible uses by removing a threat to that ecosystem or habitat, including regulatory actions and the purchase of land and easements.
QA/QC	Quality Assurance Quality Control
Radius of curvature	See diagram.



Recycled water	Water that has gone through a sewage treatment plant and is then re-used for irrigation or other purposes.
Rehabilitation	Action taken by the District to assist in improving disturbed and degraded environments through the reparation of ecosystem processes and productivity. Rehabilitation does not necessarily reestablish the pre-disturbance condition, but strives to establish stable landscapes that support the natural ecosystem mosaic.
Restoration	Action taken by the District, to an extent determined and defined by the Board, toward the re-establishment of an ecosystem's pre-disturbance structure, function, and value, where it has been degraded, damaged, or otherwise destroyed
Riffle	Shallow rapids, characterized by a locally relatively steep gradient, often shallower and "bumpier" on the surface than pools or glides; usually

	located at the crossover in a meander of the active channel.
Right of way	Land ownership or legal access to land
Riparian (riparian zone)	Referring to the riverside or riverine environment next to the stream channel, e.g., riparian, or streamside, vegetation.
Rock weirs	Weir made of rocks. See weir.
Roughness (elements)	A term used by hydraulic engineers and hydrologists designating a measurement or estimate of the resistance that streambed materials, vegetation, and other physical components contribute to the flow of water in the stream channel and floodplain. It is commonly represented by the Manning’s roughness coefficient “n”.
Routine flow	The flow that a channel is generally subject to; base flow or the less than one-year flow. This is not a measurable or quantifiable but a concept of what flow a channel generally conveys.
Scour	The erosive action of flowing water in streams that removes and carries away material from the bed and banks.
Sediment balance	Refers to the sediment transport (see below) within a reach of stream being in balance, such that sediment in = sediment out; when a balance is maintained, there is no appreciable net erosion, scour or deposition on the bed or banks of the stream reach.
Sediment transport	The movement of soil particles in flowing water; including but not limited to erosion, deposition, scour.
Sinuosity	Natural channels are rarely straight. Sinuosity is a term indicating the amount of curvature in the channel. The sinuosity of a reach is computed by dividing the channel center line length by the length of valley centerline (roughly, the distance as the crow flies). If the channel length/valley length ratio is more than about 1.3, the stream can be considered meandering in form.
Special status species	Includes plant, fish, and wildlife species that are listed, proposed for listing, or candidates for listing as threatened or endangered under the federal or California Endangered Species Act. Also includes plant species that are listed by the California Native Plant society. The Federal Endangered Species Act and California Engendered Species Act both allow for plant or animal species to be 'listed' if the continued existence of the species is threatened. Under CEQA, species listed by the California Native Plant Society can also be considered a special status species for consideration of the environmental impacts of a project. Each of the listing schemes have different levels of severity - such as endangered or threatened.
Stagnant water	Water that is not moving or flowing.

Stakeholders	Any agency, organization, or individual that is involved in or affected by the decisions made in the development of a project.
Stream bank	The side slopes of a channel between which the stream flow is normally confined.
Stream bed	The bottom of a channel.
Stream channel	A channel with flowing water at least part of the year.
Stream corridor	An ecosystem that usually consists of three major elements: stream channel, floodplain, and transitional upland fringe. Together they function as dynamic and valued crossroads in the landscape. Water and other materials, energy, and organisms meet and interact within the stream corridor over space and time. This movement provides critical functions essential for maintaining life such as cycling nutrients, filtering contaminants from runoff, absorbing and gradually releasing floodwaters, maintaining fish and wildlife habitats, recharging ground water, and maintaining stream flows. See also river corridor and riparian corridor.
Structural	Of or relating to a structure (a constructed unit).
Subsidence	Sinking of the ground surface owing to removal of large amounts of water from the underlying aquifer.
Tidal	Of or relating to the tide, the twice daily rise and fall of the surface level of San Francisco Bay.
Tidal prism	The volume of water within a creek or slough between low water and high water; this volume depends on water input from the bay (tides) as well as freshwater input from surrounding drainage (runoff).
Vector	An organism that carries pathogens from one host to another-mosquitoes are common aquatic vectors subject to “vector control”.
Water quality	The chemical, physical and biological properties of water that affect its suitability for use.
Watershed	An area confined by topographic divides that drains a given stream or river. The land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water, such as the San Francisco Bay. For example, in this county, all the creeks and rivers in the Guadalupe Watershed, including water from storm drains, flow into the Guadalupe River, then north (downstream) into the San Francisco Bay.
Watershed context	The physical, ecologic and social aspects of a watershed that provide the context within which a river project must be considered to be successful. A good understanding looks beyond the current condition to projected

	changes in the watershed from natural or human-induced alterations.
Watershed input(s)	Physical inputs from the watershed into the stream system that affect the functions and process of the creek; in general this refers to water and sediment loads and how they affect the geomorphology of the stream system. These can be represented by: • Flow-duration curve • Range of expected flows at various frequencies • Estimated sediment supply, including quantity, quality, size range
Watershed stewardship	The goal of watershed stewardship is to increase public understanding and awareness about watersheds, promote better stewardship of private lands, and develop funding to sustain watershed management efforts. There 6 basic programs that watershed management should consider to promote a greater watershed stewardship: watershed advocacy, watershed education, pollution prevention, watershed maintenance, indicator monitoring, restoration.
Weir	An overflow structure built across an open channel to raise the upstream water level and/or to measure the flow of water.

APPENDIX B

Additional Information on Individual Objectives and Criteria

NOTES From Technical Team Discussions, 2004

Technical and Advisory Notes on Using the Rating Criteria to Assess Alternatives

B-1: Provide protection from flood damage (flood protection)

B-2: Integrate within the context of the watershed (watershed context)

B-3: Support ecologic functions and processes (ecology)

B-4: Integrate physical stream functions and processes (geomorphology/ stable channel)

B-5: Minimize maintenance requirements (maintenance)

B-6: Protect the quality and availability of water (water quality and quantity)

B-7: Cooperate with other local agencies to achieve mutually beneficial goals (local partner agencies)

B-8: Maximize community benefits beyond flood protection (community benefits)

B-9: Minimize life-cycle costs (life-cycle costs)

These notes provide some background information on the rating guidance associated with the natural flood protection objectives and criteria. Most of the material has been derived from the technical work-sessions held in August 2003 on each of the topics. Other material is included as comments and suggestions from reviewers.

Technical participants for each of the technical teams are listed as part of each sub-appendix.

B-1: PROVIDE PROTECTION FROM FLOOD DAMAGE (FLOOD PROTECTION)

TECHNICAL TEAM PARTICIPANTS			
District Staff	**FEMA**	**SF Regional Water Quality Control Board**	**Silicon Valley Manufacturer's Association**
Usha Chatwani Sara Duckler Kenn Reiller Sue Tippets	Cynthia McKenzie	Paul Amato	Margaret Bruce

1.1 Safety

This criteria supports the idea that a plan should not be "brittle"; project features should present a minimal risk of catastrophic failure if something were to "go wrong" or occur outside the bounds of the design assumptions. Potential failure modes should be thoroughly understood, and should result in only "nuisance" – not dangerous – flooding. For example, flood waters that may escape into developed areas should be less than one foot in depth and not fast moving.

Furthermore, under any foreseeable condition, the project should decrease, not increase, the risks of dangers due to flooding. One objective in ensuring a "safe" design is to look at reducing "residual flooding" – flooding that would occur when design assumptions are exceeded. The plan/ design should be verified with sensitivity analyses for design variables that could influence the plan's effectiveness/ factor of safety. Examples that should be analyzed include:

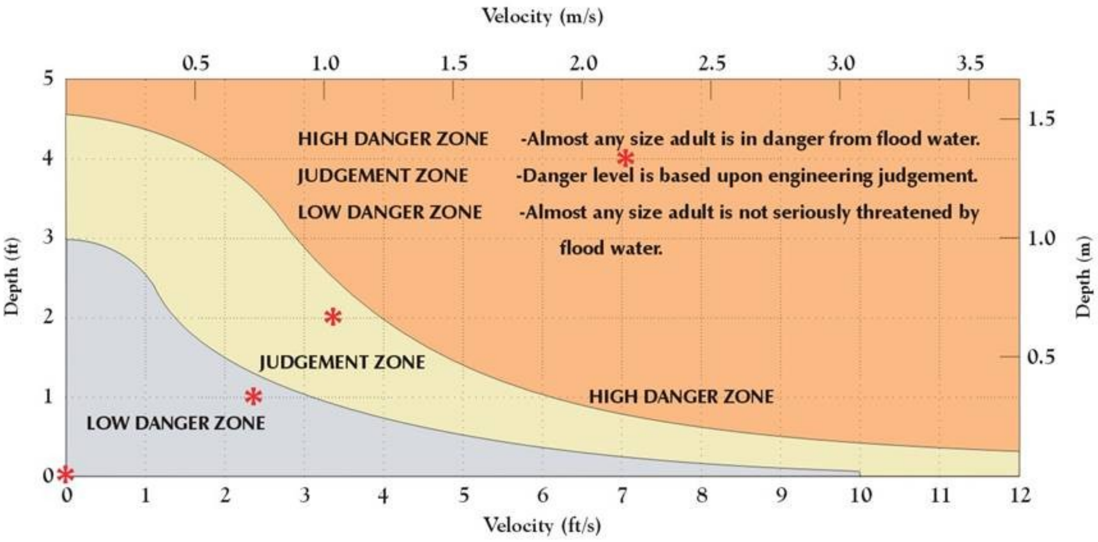
- Range of flow rates – Q's
- n-values
- structural features
- geotechnical stability
- size and shape of hydrograph – knowledge of total volume of water will provide a greater measure of project success than cfs for certain designs (for instance, detention/ retention schemes).

An example sensitivity analyses would be to run the hydraulic model for a range of Q's to verify that the project does not fail or induce dangerous (fast and/ or deep) flooding. A suggestion to use the 500-year flow is made because the Q-500 is often readily available through FEMA FIA studies. Another important factor is the design hydrograph – the project should function as designed even with back-to-back storms. Such an analysis would account for the volume of water in concert with the peak flows, which are often used for design purposes. Other design factors should be tested in similar ways to assure a robust, resilient design and to fulfill the professional/ ethical obligation that implementation of the project would leave the community safer under foreseeable circumstances, than the "no project" conditions.

This criteria attempts to support the safety of residents and visitors on the one day of every (Statistically-speaking) 36,500 when a major flood event occurs. Criteria 8.1 "Community

Safety” addresses the comfort and safety of residents and visitors on the other 36,499 days, when major flooding may not be occurring, but human interest in the project areas leads them to the physical location.

The attached chart, adapted from the Bureau of Reclamation and provided by PACE Engineering Inc., provides a reference for how depth and velocity of floodwaters combined can threaten the safety of adults entering moving water. As a general rule for adults, a safety hazard exists when the depth in feet multiplied by the velocity in feet per second exceeds about three.



Depth-velocity flood danger level relationship for adults.
(Source B.O.R.)

This will also be critical in looking at recreation safety (Criteria 8.1)– keeping deep and/or fast flowing waters separated from recreation access areas. An interesting application of this principle is to provide a gradually sloping area adjacent to trails/recreation areas. The idea (reference the recent recreation trail along the Santa Clara River in Santa Clarita, L.A. County) is that people won’t venture into water as it gets deeper and faster, but there exists a safety buffer zone where the water is neither deep nor fast, in case someone accidentally ventures in.

All projects should include an “Emergency Action Plan” to address conditions exceeding design capacity or project failure. The analyses conducted as part of the preceeding recommendations would inform such a Plan.

1.2 Economic Protection

This criterion has traditionally dominated the alternative planning and selection process, as it is straightforward to measure and fits easily into a traditional Benefit:Cost analysis. An important consideration of this criterion is that economic protection is afforded not only by protecting off-stream structures from floodwaters, but also by minimizing erosion, deposition and other instream damages that could occur due to high flows. Erosion and associated property loss must be considered as a potentially significant economic impact. Other potential instream/ onstream damages must also be assessed.

1.3 Durability

This criterion derives from the idea that flood protection should minimize reliance on human intervention. This is ideally true both during an event (avoid reliance on “real time” flood fighting techniques) as well as over time (minimizing long-term maintenance requirements). The ideal is that, even if future funding for maintenance activities is curtailed, a capital project should function as designed for its projected lifespan (generally 50 years).

A simple analogy is provided by the automobile industry. Today’s new cars have a recommended *first* scheduled engine maintenance at 100,000 miles. Not long ago, people junked their cars when they reached 100,000 miles. That’s an improvement in durabilty!

1.4 Resiliency

The criterion addresses the need for a channel to be adaptable to future changes in hydrology – for example, due to development. The criterion distinguishes between providing capacity for ultimate potential conditions and providing a design that could be adapted in the future to meet future needs. This criterion favors an adaptable design over an “over-designed” channel. A simple example of this principle would be to design levees with a wider base than necessary for the current design height, providing the ability to add height *in the future* if necessary, without the need to acquire additional right-of-way or reconstruct the levees from the ground up.

1.5 Local Drainage

The local (city) storm drain systems should function seamlessly in conjunction with flood conveyance channels to avoid localized street flooding. This issue is addressed when obtaining a FEMA Letter of Map Revision, but the planning team should be aware of this as a customer-service requirement.

1.6 Time to Implementation

This criterion addresses the technical, economic and political feasibility of a proposed project. Some projects are inherently more “buildable” under our current permitting and construction system than others – for better or worse. The bottom line is that the more complicated a project would be to fund, permit or construct, the longer it might take to implement. Meanwhile, the flood-prone properties continue to be subject to a flood risk. Additionally, other factors (such as environmental or recreation) that might be improved by the project continue to remain unaddressed. This period of time is relevant when considering the overall costs and benefits of a potential project. Some project aspects that might contribute to an increased time-to-implementation include:

- Multiple jurisdictions
- Multiple funding sources
- Complex environmental issues
- Presence of endangered species
- Right of way acquisitions
- Complex regulatory issues
- Cultural resources in area
- Significant construction in high-traffic areas
- High cost of proposed project

It is up to the project rating team to confer with the project planning team to get the necessary information to make a judgement on this criterion.

B-2 INTEGRATE WITHIN THE CONTEXT OF THE WATERSHED

TECHNICAL TEAM PARTICIPANTS		
District Staff	**Audubon Society**	**SF Regional Water Quality Control Board**
Wendy Chang Mike Coleman Al Gurevich Terry Neudorf Ngoc Nguyen Afshin Rouhani Dipankar Sen Bill Smith Sarah Young	Craig Breon	Richard McMurtry Mike Napolitano

2.1. Meets Local Watershed Goals

One of the primary considerations in providing natural flood protection is the need for the project team to look beyond the project boundaries and consider the project in light of the entire watershed, and the project's place within the watershed.

Ideally:

> Watershed goals are established in a watershed plan created through a comprehensive stakeholder process that considers current and ideal biological and geomorphic conditions and relevant land use and social issues. The Watershed Stewardship process, which is underway for the Lower Peninsula, West Valley and Guadalupe Watersheds (2004) should provide the necessary framework for such an analysis for projects within these watersheds.

If not, then:

> The project team involves the public and other stakeholders to develop watershed-wide goals as part of project planning

If not, then:

> The project team examines other watershed related goals such as endangered species goals, general plan goals and policies, park plans, etc

B-3 ECOLOGIC PROCESSES

TECHNICAL TEAM PARTICIPANTS		
District Staff	**San Francisco Estuary Institute**	**SF Regional Water Quality Control Board**
Jae Abel Judy Ingols Doug Padley Gale Rankin Linda Spahr	Robin Grossinger	Richard McMurtry

3.1: Habitat Goals

This criterion is based on the development of watershed based ecological goals that define the appropriate target ecological functions and processes for the project reach based on an understanding of the past, present and projections of change within the watershed. Such goals would be developed as part of a Watershed Stewardship or Watershed Management Plan or a Habitat Conservation Plan or other relatively detailed, science-based study of watershed ecological processes.

A Watershed Plan should provide a set of well-defined, broadly supported ecological goals for the watershed based upon a scientifically valid understanding of its historical, current and potential biophysical characteristics. The ideal flood protection project should support those goals. In the absence of such a plan, the project planning team should either develop a plan or research or define existing goals outside the context of a comprehensive plan. Such an effort is recognized as compromised achievement of this criterion, because there is less assurance that the goals are appropriate.

3.2: Habitat Provided

This criterion measures a qualitative attribute, yet the analysis need not be totally subjective. Biologists familiar with the local area and a local watershed management document should be involved in assessing this criterion. On a broad level, some examples of habitat attributes to consider when assigning a rating to this criterion include:

- Construction area/ project area is revegetated with native vegetation derived from within the same watershed;
- Removal of non-native / invasive vegetation;
- Public access is restricted to sensitive areas;
- Buffer between sensitive areas and adjacent land uses;
- Diverse vegetation community vertically and longitudinally;

- Appropriate soil conditions to support, without human interference, native vegetation and wildlife needs;

- Minimal hardscape or hard structures;

- Diversity of hydraulic regimes, for example back-water areas that provide different habitat attributes than high-flow areas;

- Varying width of channel and floodplain – this helps in providing hydraulic diversity;

- Vegetation is used appropriately to moderate water temperature (SRA);

- Topographic relief / meanders provide habitat diversity;

- Upland areas are appropriately preserved, planted, and/or protected to support appropriate vegetation and wildlife species;

- Water quality is protected/ considered in project design (see Objective 6 and related criteria); and

- Floodplain provides a variety of habitat areas – for example more than merely grassland designed for high flows.

3.3: Sustainability of Habitat

This criterion measures the potential that a project will support appropriate vegetation throughout its lifespan. To be self-sustaining, the project team must examine attributes such as:

- Appropriate native plant palette
- Soil conditions
- Soil moisture conditions
- Depth-to-groundwater
- Topography
- Micro-climate

And other site-specific conditions that would affect whether a mosaic of appropriate vegetation would be self-sustaining without assistance from humans. The project team should also evaluate opportunities for the habitat to self-adjust appropriately to future changes in the physical site conditions, and the potential for non-native invasive species to overtake habitat.

3.4: Connectivity of Habitat

This criterion assesses whether the proposed plan provides an appropriate wildlife corridor for terrestrial and aquatic species to migrate within and beyond the riparian area supported by the project reach.

Additional Guidance on Evaluating Habitat Quality and Appropriateness

The following checklists and questions were developed by District staff in response to California's AB1147 (2002), a bill that sought to allocate funding for flood protection projects partially based on the project's ability to provide quality habitat. Reviewing this list of topics and questions may prove helpful to a project team in developing and rating alternatives for their contribution to the ecologic process objective.

Consider the following habitat types:

- Aquatic Habitat
- Riparian Forest
- Upland Forest
- Jurisdictional Wetlands
- (Other habitat types, as appropriate)

Measurement of the quality of the habitat should account for the uniqueness of the features in relation to the surrounding area and its preservation for the future. Rating should take into account the opportunities and constraints, and the value of the habitat to the general area.

Quality Rating for Habitat

No habitat value: Consists of paved areas or areas with no vegetation.

Some habitat value: Greenscapes such as landscaped park areas, agricultural land; undeveloped areas with high public access. (Note that areas with a low rank of 1 for habitat value may have a high rank of 3 for recreation value; each objective would be ranked separately).

Good habitat value: Area is useful to wildlife, without particular attention to native or endangered species; area could include natural (unlandscaped) areas, but with non-native plant and animal species present and uncontrolled; some public access.

High habitat value: Area would be relatively undisturbed, contain primarily native plant species and have a high potential to meet the needs of native wildlife including aquatic, avian and terrestrial species. Project has addressed the special needs of native, endangered or special status species; public access is restricted.

The following questions relate to the setting of the project, its opportunities and constraints:

- Is a significant portion of the surrounding area developed, thereby constraining the opportunity to provide habitat value in the project area?
- Was the area previously developed and will be reclaimed by the project to habitat for special status species?
- Is the project within an adopted Urban Growth Boundary?
- Is the project area currently NOT protected within a locally designated open space, greenway, or parkland? (Answer "No" – zero points. -- if it is currently protected)

- Was plan formulated with participation from a Stakeholder group, with an environmental advocacy group as one of the members?

Additional Features and Future Management (Habitat)

The following questions relate to final configuration of Proposed Project:

Native Plant Restoration:

- Are California native plants used for revegetation?
- If yes, are native plants derived from within same watershed?
- Are non-native plants removed?

Connections to Other Habitat Areas:

- Are habitat areas close to other, non-project habitat areas of the same type?
- Are habitat areas adjacent and contiguous to non-project habitat areas?
- Do project habitat areas form a continuous corridor (provide gap infilling) with non-project areas?

Educational Opportunities:

- Is there educational signage?
- Is there a lookout or path with interpretive signage?
- Is there an interpretive center?

Access to Sensitive Habitat Areas:

- Are sensitive areas protected with fences?
- Are sensitive areas protected with signage?
- Will rangers or docents patrol the area?
- Is buffer provided between sensitive habitats and adjacent land use?

In-stream Functions (Below Ordinary High Water):

- Is in-stream escape cover provided by undercut banks, large boulders, tree roots, downed trees or other structural elements?
- Is hydraulic complexity provided, resulting from interaction of current with similar elements as those providing in-stream cover?
- Is refuge from high velocity provided, resulting from interaction of current with similar elements as those providing in-stream cover?
- Is shade/ water temperature moderation provided by mature riparian shrubs and trees?

- Is overhanging escape cover provided by shrubs and grasses near the stream edge?
- Is final project fish passable?

Stream-Side Environment (Upland, Adjacent Vegetation):

- Is sediment stabilization provided by riparian trees, shrubs, grasses or other biotechnical means?
- Is bird breeding and foraging habitat provided by mature native riparian species, such as cottonwoods, willows, oaks, other trees, shrubs, forbs, grasses, and the streambank itself?
- Are foraging, refugia, estivation, and breeding habitat provided for semi-aquatic amphibian and reptile species by low vegetation, rocks, downed materials, and the streambank itself?
- Are foraging, refugia, estivation, and breeding habitat provided for mammals by low vegetation, rocks, downed materials, and the streambank itself?

Maintenance:

- Does Project allow for natural growth within active channel (versus flowage requirement to maintain “clean” channel)?

The following page provides a checklist format that might be useful in assessing a proposed project’s ability to meet the habitat needs of the appropriate assemblage of wildlife in the appropriate life-cycle stages.

The project biologist(s) should determine what species are appropriate to the site, and if the project will provide for their needs.

Is the project design conducive to…?

Y = Yes
S = Somewhat
N = No
-- = Not Applicable

FISH	Eggs	cover	_______	BIRD	Nest	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
	Juvenile	cover	_______		Migrant	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
	Adult	cover	_______		Resident	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
AMPHIBIAN	Eggs	cover	_______	MAMMAL	Breeding	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
	Juvenile	cover	_______		Adult	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
	Adult	cover	_______	INVERTEBRATE	Reproduction	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
REPTILE	Juvenile	cover	_______		Larvae	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______
	Adult	cover	_______		Adult	cover	_______
		passage	_______			passage	_______
		food	_______			food	_______
		space	_______			space	_______

B-4 GEOMORPHOLOGY: PHYSICAL CHANNEL FUNCTIONS AND PROCESSES (NATURALLY STABLE CHANNEL)

TECHNICAL TEAM PARTICIPANTS	
District Staff	**Guadalupe-Coyote Resource Conservation District**
Sara Duckler Seena Hoose Scott Katric Afshin Rouhani Kenn Reiller	Larry Johmann

Glossary

Because of the abundance of technical terms used in defining criteria and rating guidance for Objective 3, the Glossary (Appendix A) is an important reference for understanding terms and concepts.

Related Efforts

As noted in the introduction to the criteria rating guidance section , the criteria for this objective are tied to the San Francisco Bay Regional Water Quality Control Board's Technical Reference Circular W.D. 02-#1 "A Primer on Stream and River Protection for the Regulator and Program Manager." However, the technical guidance provided in that Primer corresponds largely to the creeks of East and North San Francisco Bay. South Bay creeks and rivers function under a different hydrologic micro-climate and within a different geologic setting. Therefore, the project team may need to exert significant effort toward understanding local geologic, hydrologic and geomorphic conditions rather than blindly applying regional data that may or may not be appropriate.

There are at least two efforts currently underway (2004) to provide guidance to District staff in these arenas. When the various guidance documents have been produced, they will be referenced in the appropriate ISO document repositories.

1. In 2003, Capital Projects Services Division initiated a design manual consisting of three parts; river hydraulics; sediment transport & erosion protection; and fluvial geomorphic investigations. They expect to complete a draft version of this manual by the end of June 2004. This manual should provide guidance to staff for future capital and maintenance project planning and design. (Jim Wang and Liang Lee; March 2004)

2. In the Watersheds, an Action Plan has been developed to provide specific guidance to staff working on creek stability issues. The approach to providing design guidance will be based on models used elsewhere in North America, using calibrated models of creek behavior. A comparison of design approaches to stabilize urban streams in Ontario and British Columbia, Canada, in the Northwest, and in areas of Texas, show that the planners, engineers and field crews undertake a multi-step approach to providing geomorphically stable channels. Their designs have withstood major storm events very successfully. The approach used consists of (1) collection of relevant scientific data on the geomorphology of the watershed, (2) use of appropriate hydrologic and shear stress models to compute and calibrate results to all storms from 0 to 10 year frequencies, in addition to the 10 to 100 year frequencies, (3) development and testing of design elements based on the models, (4) preparation of construction documents and field installation instructions that are appropriate for such designs (e.g.: natural flood and erosion protection measures require more latitude given to field crew to customize installation together with the engineer in the field, which means that the field crew and contractors need to have a higher level of training in correctly installing them), and (5) modify the design after the first wet period of operation (engineer with this flexibility).

The guidance will be tied to ISO Level 2 Procedures for Watershed Operations. An outline of the approach now underway at the District includes:

1. Develop and implement a Level 2 Procedure for Natural Erosion and Flood Protection SMP and Capital Project Designs which includes:

    a. Field Data Collection
    b. Use of appropriate models and computational tools
    c. Development and testing of design elements
    d. Preparation of construction documents/field installation instructions
    e. Design adjustments following operation

2. Incorporate updated and enhanced model/computational tools into:

    a. Design of new capital projects
    b. Facility maintenance guidelines

3. Implement a system for monitoring and improving success rates:

    a. Establish appropriate KPI(s)
    b. Establish rating criteria and methodologies
    c. Establish a program for:

        i. Rating BMPs and quantifying performance
        ii. Identifying improvements
        iii. Incorporating improvements into above 1 & 2 elements

4. Provide training to staff on design procedures and monitoring system.

Natural Flood Protection Data Needs – a brief discussion

Following is some advice from Ms. Seena Hoose, Engineering Geologist at the District about the need for data collection and management on geomorphic issues.

The concept of Natural Flood Protection begins with the stream geomorphology and the geomorphology of the land along the streams. The collection of appropriate data is critical to the success of any project. The data set must be both valid and reproducible. This type of data validity is only obtained when the data to be collected and the methods for collecting it are clearly spelled out and the data collection is consistent from one project to the next. The appropriate and defensible standard of care must be applied to all the data collection and interpretation.

This data is expensive to collect. Some of it needs to be updated annually. The data must be obtained by appropriately trained and licensed individuals, land surveyors, geologists, biologists, etc. The data needs to be stored, maintained, and updated in a consistent manner for the long term. Thus a data storage methodology should be established, one which can show changes through time.

Presently the geomorphic data appears to be collected on a project basis and not on a stream/watershed basis. For example, thalweg data is collected for the measured sections across the stream at certain points, but the thalweg position, slope, and identification of changes in stream slope are not measured along the stream from the top of the ridge to the bay. Consistent and uniform data collection on a project basis can be added to other project data and eventually a complete data-set will be collected for each stream.

Additional notes adapted from comments made by Seena Hoose, on the non-standard geomorphology of Santa Clara County.

Q: Does the “standard” geomorphic model apply to Santa Clara streams?

A: No.

Discussion: Data on meanders can be developed from topographic maps of the 1800’s (1860’s Coast and Geodetic Survey) and early 1900’s (USGS 1917) and airphotos (1938). Should base design on local conditions.

Q: Is incision of streams due to urbanization?
A: Not always

Discussion: San Francisquito Creek moved from Ravenswood Point to Charleston Slough about 800 years ago. Age dates from the natural levee in Palo Alto (below the surface) show incision 3,000 years ago. End of Pleistocene rainfall was between 7,000 and 10,000 years ago. Incision began after that change. In this case, a decrease in rainfall led to increased erosion/ incision.

Q: Is bankfull represented by current conditions?
A: I don’t know.

Discussion: I am not certain what “bankfull” means when streams are incised (naturally). Age dating of terraces inside the incised channels and of natural levee deposits will yield the answer.

Examples of information required for proper design of active channel:

Watershed Inputs

- Flow-duration curve
- Range of expected flows at various frequencies
- Estimated sediment supply, including quantity, quality, size range

Channel Reach Characteristics

- Channel slope
- Valley Slope
- Confinement
- Entrenchment

B-5 MINIMIZE MAINTENANCE REQUIREMENTS

TECHNICAL TEAM PARTICIPANTS		
District Staff	**SF Regional Water Quality Control Board**	**Environmental Protection Agency**
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Maintenance Team Collaboration:

A key element to successfully meeting this objective is to convene and collaboratively engage a field maintenance team from initial alternatives conceptual development through final design phase. This allows for full incorporation of expertise from experienced maintenance workers, engineers, administrators, planners and operators from the Watershed Field Operations units. Ideal outcomes achievable by such a collaboration would include:

- Long-term maintenance issues fully understood
- Maintenance costs are understood (these will be reflected in life-cycle cost estimate)
- Collaboration throughout process
- Reduction in cost and impacts achieved by incorporating input

5.1 Structural Features

Examples of structural features include:

- access roads
- outfalls
- grade control structures
- fish ladders
- fences
- bridge piers
- undersized bridges/culverts
- surfaces susceptible to graffiti/vandalism

5.2 Natural Processes

Steps that should be taken in the planning phase and reviewed by the evaluation team include modeling sediment processes and vegetation growth so that they are understood in terms of future maintenance requirements. Ideally:

- A peer-reviewed sediment transport model has been calibrated to existing site conditions.

- Each alternative is modeled separately for sediment transport mechanisms and projections

- For each alternative: Best available data is used to estimate or model vegetative growth and results are incorporated both as influences on n-values and as reduction in channel cross-sectional area.

5.3 Urban Flows

This criterion addresses the damage that higher-frequency (lower-magnitude) flows incur over time. Typically, flows in the 1 to 10 year return period are responsible for significant bed and bank erosion as well as sediment deposition. These are the flows typically handled by local storm drain systems; thus outfall management is an important consideration in this criterion. For additional information, see section B-3 of this Appendix, which discusses establishing a geomorphically appropriate and stable channel based on both low-magnitude and high-magnitude flows.

5.4 Access

While existing district policy provides guidance on requirements for maintenance roads, there is an opportunity to provide maintenance access in a manner that is less prescribed, but more consistent with projected needs. Such a customized approach might enable the project to better support both the need for appropriate access AND a naturally stable active channel with integrated floodplain. As one example, maintenance roads could be placed at bankfull height, allowing water to flow over them during events, but providing near-channel access the rest of the year. For areas where real-time, high-flow maintenance is not likely to be required, this system could work well in supporting both objectives and should be investigated as a means of reducing overall maintenance road “real-estate” requirements.

For reference, District Policy 3-140, which provides maintenance road construction criteria, is provided below:

District Policy 3-410, Flood Control Maintenance Road Criteria

Construction and maintenance of flood control facilities require adequate access for heavy equipment and vehicles. Maintenance roads for channels must be coordinated with public trafficways and must provide continuous access to and along all areas under District responsibility. Roadway width must be sufficient to allow equipment travel and operation at all points along the channel. The number and width of flood control access roads vary with the size and design of channel. District experience indicates that the following minimum criteria for maintenance access roads are required.

NUMBER OF MAINTENANCE ROADS: Concrete-lined Channels – one (either side). Earth channels (25ft or less in width) – one. Earth channel (greater than 25ft wide) – two (one on each side).

WIDTHS OF MAINTENANCE ROADS (EXCLUSIVE OF DRAINAGE DITCH): Maintenance roads at grade or depressed (channel less than 40ft in width) – 15 feet clear width. Maintenance roads at grade or depressed (channel width more than 40 feet) – 18 feet clear width. Maintenance roads elevated (minor channels) – 18 feet clear width. Maintenance roads elevated (major channels) – 21 feet clear width.

EQUIPMENT SWING WIDTHS: Channel 30 feet or less in width – 15 feet. Channel over 30 but less than 40 feet in width – 18 feet. Channel 40 feet or more in width – 22 feet. The channel width used in the delineation of numbers of roads and their widths is defined at the elevation of the maintenance road. The maintenance road widths are expressed in clear widths unencumbered by landscaping and fences. The equipment that uses these maintenance roads requires swing room for operation as indicated; these swing widths include the maintenance road and can include adjacent low shrub landscaping but must be clear of trees or tall fences. Where the points of access to maintenance roads along the channels are more than 1,000 feet apart, passing areas of at least 25 feet clear width will be provided about 500 to 800 feet apart. Where the maintenance road dead-ends and no access to the road is available, turnarounds of at least 30 feet outside of and adjacent to the maintenance road will be provided.

B-6 MAINTAIN OR ENHANCE THE QUALITY AND AVAILABILITY OF WATER

TECHNICAL TEAM PARTICIPANTS	
District Staff	**CLEAN South Bay**
Francis Brewster Debra Caldon Mark Merritt Carol Presley John Shay Ken Stumpf Laura Young	Trish Mulvey

6.1. Groundwater Recharge

Of particular interest in preserving the recharge capacity of creeks are those areas that are known to recharge into the managed groundwater basin. Project teams should consult, at an early stage, the SCVWD recharge zone maps to determine whether the project is in a known recharge zone. Contact the Operations Planning and Analysis Unit for a map.

Even if the project area does not connect to the managed groundwater basin, there are other benefits to preserving the permeability and recharge potential of a creek reach.

Examples of project attributes that would increase the recharge potential:

- Removing or eliminating hardscape or impervious surfaces in recharge zones – priority given to instream recharge.
- Eliminating/reducing recharge-inhibiting compacted soil areas such as roads, levees or construction staging areas. Also decompacting such areas if/when they are no longer needed.
- Increasing the coarse-to-fine sediment ratio in recharge zones
- Excavating areas in recharge zones and/or routing high flows to recharge areas that would otherwise receive less water such as
    - o bypass channels
    - o floodplains
    - o detention basins

  Excavation increases recharge potential by decreasing the travel distance for surface water to reach groundwater.

6.2. Channel Features

Complexity in the channel encourages mixing and aeration of flowing water. Such features are encouraged as a means to protect or improve water quality. Examples of complex channel features include:

Large-scale features

- Sinuousity
- Riffle/pool/run sequence
- Low-flow channel
- Large woody debris
- Root wads

Small-scale features

- Varied substrate
- Mobile bed
- Boulders
- Undercut banks

6.3. Vegetation

Near-channel and in-channel vegetation provides water quality benefits through physical filtration of overland flow, and by providing temperature-moderating shade and bank-stabilizing structure. Examples of measurable factors include:

- Extent of riparian buffer zones
- Coverage of riparian canopy (%)
- Extent of stable and vegetated stream banks
- Number of willow and cottonwood (post) plantings
- Density of plantings
- Short-term canopy coverage vs. long-term canopy coverage

6.5. Pollution Reduction

Examples of project elements that could decrease pollution potential include:

Physical Features

- Incorporates measures to discourage trailcutting/improper access

- Outfalls are reduced or incorporate treatment measures that fulfill recommendations of the URMPPP Hydromodification Plan

- Right-of-way acquisition that eliminates current or future land uses that contribute contamination

- Incorporates vegetated buffer strips to filter overland flow

Educational/Outreach Opportunities

- Provides opportunities to foster public education on pollution prevention

- Project is connected to local “Adopt-A-Creek” group

- Project plan includes involvement of one or more organized local community groups, including schools, neighborhood associations or local recreation programs

B-7 Cooperate With Other Local Agencies to Achieve Mutually Beneficial Goals

TECHNICAL TEAM PARTICIPANTS	
District Staff	**City of Sunnyvale**
Rick Callendar Usha Chatwani Melissa Dargis Michael Martin Mike Munson Bill Springer	Gerri Caruso

An outline of a process to actively include relevant staff from local agencies was created by the team that defined the rating criteria for this objective. This proces (Local Agency Inclusion Process) can be included in the Project Plan, which is a contract between the Watershed Manager (owner) and the project planning team.

LOCAL AGENCY INCLUSION PROCESS:

1. Scoping

- Determine appropriate local agencies to contact
- Determine appropriate staff contact at each local agency
- Describe project parameters (Measure B – also as defined in Project Plan)
- Determine administrative process and channels for communication
- Agree on documentation process / minutes including all decisions

2. Memorandum of Consensus

- Form partnership / collaborative between District and agency
- Collaboratively define goals and objectives of all agencies involved
- Establish guidelines for participation – how and when the local agency will participate in the development of the project design
- Develop memorandum of consensus to be adopted by governing boards

3. Alternative Development

- Provide agencies adequate time to respond
- Adhere to communication and decisionmaking protocols established in scoping
- Local agency reviews alternatives with respect to compliance with their general plan
- Maximize existing approved funding
- Explore cost sharing for potential project enhancements

As part of understanding mutual goals, the project team must collect and review the general plan(s) for all local agencies that the project is in.

B-8 MAXIMIZE COMMUNITY BENEFITS BEYOND FLOOD PROTECTION

TECHNICAL TEAM PARTICIPANTS		
District Staff	**Audubon Society**	**San Francisquito Creek Watershed Alliance**
Mala Magill Karen Morvay Patricia Showalter Gerry Uenaka	Craig Breon	Katie Pilat

This objective identifies and measures the benefits that a local community can gain from a well-planned river project.

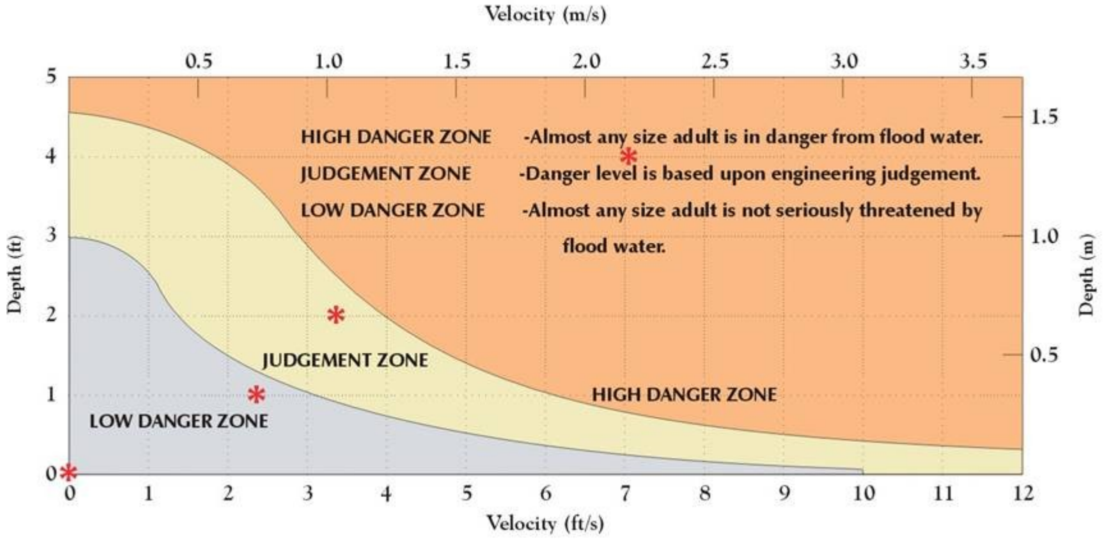
8.1. Community Safety

The following is a list of features and amenities that can be incorporated into a project to increase the safety of project users. This is not an all-inclusive list, and these features should be reviewed by public safety officials in conjunction with the plan/layout to determine appropriateness of any individual feature.

Measurement of success should include plan review by public safety experts such as law enforcement, park rangers, risk management, etc.

- Phones / call boxes
- Emergency vehicle access
- Cross-walks, pedestrian light signals
- Lighting
- Signage
- Adequate visibility around project features and vegetation
- Pedestrian access
- Continuous trails under streets
- Discourages illegal / destructive use
- Trails maintained
- Ranger patrol

The attached chart, adapted from the Bureau of Reclamation (provided by PACE Engineering Inc.), provides a reference for how depth and velocity of floodwaters combined can threaten the safety of adults entering the water. As a general rule for adults, a safety hazard exists when the depth in feet multiplied by the velocity in feet per second exceeds about three. This information should be used *when developing recreational features that may be close to flowing waters*. An appropriate use of this information is to avoid incorporating any hydraulic features that would cause an abrupt transition from the “low danger zone” to the “high danger zone”. Smoother transitions would deter people from unknowingly stepping into a “danger zone” without the opportunity to retreat.



Depth-velocity flood danger level relationship for adults.
(Source B.O.R.)

8.2. Recreation

The following is a list of possible recreational facilities and amenities:

Facilities

- Trails
- Paved and un-paved trails together
- Picnicking
- Event locations
- Creates linear parks
- Boating, canoes, and kayaks
- Community gardens
- Wading
- Fishing
- Wildlife observation
- Camping
- Swimming hole
- Quiet

Amenities

- Parking access
- Bathrooms, water fountains
- Signage
- Benches
- Buffer from incompatible uses
- Pedestrian / bike bridges
- Opportunities for local schools
- Opportunities for teenagers

Access

- Open for public use
- Near public transportation
- ADA access
- Available for multiple users including hikers, bikers, horses, etc.

8.4. Social and Cultural Benefits

An analysis of social and cultural activities appropriate to site should be conducted by the project team. The analysis would include a review of existing community needs and potential future needs as identified in the general plan of the city or county
The following is a list of considerations of social and cultural benefits that can be incorporated into a project if appropriate:

Education / Interpretation—Signs, kiosks, outdoor classroom space, programs (for local schools, community) on:

- Geology
- Wildlife (e.g., fish viewing windows, observation point for seasonal changes)
- Hydrology (e.g. water recycling)
- Infrastructure / alteration
- Human impacts (e.g. think about watershed in every day lives)
- flooding (e.g. high water markers with public and web viewing access for real-time flow monitoring)
- Local history (e.g. role of stream in community's history)
- Archaeology
- Concept of watershed (e.g. signs showing location in watershed)
- Historical ecology

Volunteering / Community Involvement—Opportunities for involvement in creek restoration / protection:

- Local schools have integrated roles in monitoring / protecting creek
- Community volunteering
- Community gardens
- Partnerships with non-profits

Teenagers / Homeless

- Encouraging positive/discouraging negative behavior
- Community involvement
- Art

Demographics (seniors, disabled, etc.)

- Inclusiveness
- Environmental justice

8.5. Community Input

District considers, records and responds to all comments received during planning and design process. Written record is invaluable.

The District collaborates with the public in every aspect of the decision making process including development of alternatives and the identification of a preferred alternative. The District actively seeks community input and involves the community throughout the design process. The District can seek community input through public meetings, stakeholder meetings, Project-Specific Advisory groups, Board's Advisory groups, the CEQA process, information on the web site, etc.

APPENDIX C

Criteria Rating Documentation and Justification Tables

Example Table for Objective Number 1

SAMPLE RATING DOCUMENTATION AND JUSTIFICATION TABLE

Alternative ____________________________

Objective 1: Protection from flood damage

Summary Rating: _________

No.	Criteria	Description	Assigned Weight	Assigned Rating	Comments / Justification
C1.1	Safety	Protection of public safety if conditions exceed design assumptions	30		
C1.2	Economic Protection	Protection from damage for homes, schools, businesses, transportation systems and other infrastructure	30		
C1.3	Durability	Future District effort required to maintain design level of protection	10		
C1.4	Resiliency	Adaptability to future changes external to District activities	10		
C1.5	Local Drainage	Support of local storm drain systems	10		
C1.6	Time to implementation	Time to implementation relative to other alternatives	10		

APPENDIX D

Objective Rating Matrices
(blank forms)

EXAMPLE RATING TABLE FOR SINGLE OBJECTIVE

Objective 1: Provide protection from flood damage

● Outstanding ◕ Very Good ◒ Adequate ◔ Fair ○ Poor X **Unacceptable**

Alternative	Criteria and Weights							Summary Rating
	Safety (30)	Economic Protection (30)	Durability (10)	Resiliency (10)	Local Drainage (10)	Time to Implementation (10)		
Alternative 1								
Alternative 2								
Alternative 3								
Alternative 4								

Use these icons to populate your matrix:

● ◕ ◒ ◔ ○

APPENDIX E

Alternative Comparison Matrix
(blank form)

EXAMPLE RATING TABLE FOR ALL OBJECTIVES

● Outstanding ◕ Very Good ◒ Adequate ◔ Fair ○ Poor X **Unacceptable**

Alternative		**Objective**							
	Protection from Flood Damage	**Integrated with Watershed**	**Ecological Functions**	**Geomorphic / Channel Functions**	**Maintenance**	**Water Quality & Availability**	**Other Agency Support**	**Community Benefits**	**Life-Cycle Costs**	**LEDPA**
Alternative 1									$	
Alternative 2									$	
Alternative 3									$	
Alternative 4									$	

Use these icons for matrix:

● ◕ ◒ ◔ ○

APPENDIX F

Support/Conflict Matrix

June, 2004

This matrix provides a comparative overview of which criteria are mutually supportive of others (approximately half); which are relatively neutral with respect to one another (approximately half), and which would likely conflict in their implementation (only 3%). The comparison is subjective and could differ depending on specifics within a given project.

Support/Conflict Matrix
Natural Flood Protection Criteria

	1: Protection from flood damage						2. Ecologic functions and processes				3. Physical stream functions and processes						4: maintenance requirements				5: Integrated with watershed	6. Quality and availability of water						7. Mutual Goals with other local		8. Community Benefits								9. Life-Cycle Costs		
Criteria:	1.1 Safety	1.2 Economic Protection	1.3 Durability	1.4 Resiliency	1.5 Local Drainage	1.6 Time to Implementation	2.1 Local Habitat Goals	2.2 Quality of Habitat	2.3 Sustainability of Habitat	2.4 Connectivity of Habitat	3.1 floodplain	3.2 Active channel	3.3 Meander Length	3.4 Meander Belt Width	3.5 Transitions	3.6 Stable Side Slopes	4.1 Structural Features	4.2 Natural Processes	4.3 Urban Flows	4.4 Maint. Access	5.1 meets watershed goals	6.1 Ground-water recharge	6.2 Physical Features	6.3 Vegetation	6.4 Rainfall/runoff management	6.5 Pollution Reduction	6.6 Flow Regime	7.1 Mutual Local Goals	7.2 Supports General Plan	8.1 Safe Access	8.2 Recreation	8.3 Aesthetics	8.4 Social and Cultural Aspects	8.5 Economic Effects	8.6 Green Methods	8.7 Open Space	8.8 Community Input	9.1 Capital Cost	9.2 Maintenance/ Operation	9.3 Grants/Cost-Shares
1.1 Safety		s	s	s	n	s	n	n	n	n	s	n	n	s	n	s	s	n	n	s	s	n	n	n	n	n	n	s	s	s	n	n	n	s	n	n	n	n	n	n
1.2 Economic Protection			s	s	s	s	n	n	n	n	s	s	s	s	s	s	s	s	s	s	s	n	n	n	n	n	n	s	s	n	n	n	n	s	n	n	n	s	s	s
1.3 Durability				s	n	n	n	n	s	n	s	s	s	s	s	s	s	s	s	s	s	n	n	n	n	n	n	s	n	n	n	n	n	s	s	n	n	n	s	n
1.4 Resiliency					s	n	n	n	n	n	s	s	s	s	s	s	n	s	s	n	s	n	n	s	s	n	n	s	s	n	n	n	n	s	n	n	n	n	s	n
1.5 Local Drainage						n	n	n	n	n	s	n	n	n	s	s	n	n	s	n	n	n	n	n	s	s	n	s	s	n	n	n	n	s	s	n	n	n	s	s
1.6 Time to Implementation							n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	s	n	s	s	n	n	n	n	n	n	n	n	n
2.1 Local Habitat Goals								s	s	s	s	s	s	s	s	s	s	s	s	n	s	n	n	s	n	s	n	n	n	n	c	n	s	s	s	s	n	c	n	s
2.2 Quality of Habitat									s	s	s	s	s	s	s	s	n	s	s	c	s	n	s	s	n	s	s	n	n	c	c	s	n	s	s	s	n	c	n	s
2.3 Sustainability of Habitat										s	s	s	s	s	s	s	s	s	s	n	s	n	n	s	s	s	s	n	n	c	c	n	n	n	s	s	n	n	s	s
2.4 Connectivity of Habitat											s	s	s	s	s	s	n	s	n	c	s	n	n	s	n	s	s	n	n	c	c	s	s	n	s	s	n	n	n	s
3.1 Floodplain												s	s	s	n	s	n	s	s	n	s	s	n	s	n	s	s	n	n	s	s	s	n	n	n	s	n	c	s	s
3.2 Active channel													s	s	n	s	s	s	s	n	s	s	s	s	s	n	s	n	n	n	n	s	n	n	n	s	n	n	s	s
3.3 Meander Length														s	s	s	s	s	s	n	s	n	s	s	s	n	s	n	n	n	n	s	n	n	n	s	n	c	s	s
3.4 Meander Belt Width															n	s	s	s	s	s	s	s	s	s	s	n	n	n	n	s	s	s	n	n	n	s	n	c	s	s
3.5 Transitions																s	s	s	s	n	s	n	s	s	s	n	n	n	n	n	n	s	n	n	n	n	n	n	s	n
3.6 Stable Side Slopes																	s	s	s	s	s	n	s	s	s	s	n	n	n	s	s	s	n	s	n	s	n	n	s	n
4.1 Structural Features																		s	s	s	s	s	n	n	n	n	n	n	n	n	n	s	n	n	n	n	n	s	s	n
4.2 Natural Processes																			s	n	s	s	s	s	s	s	s	n	n	n	n	s	n	n	n	n	n	c	s	s
4.3 Urban Flows																				n	s	s	n	s	s	s	s	s	n	n	n	n	n	n	n	n	n	c	s	s
4.4 Maint Access																					n	n	n	c	n	n	n	n	n	s	s	n	n	n	n	n	n	c	s	n
5.1 meets watershed goals																						s	s	s	s	s	s	n	n	n	n	n	s	n	s	s	n	n	s	n
6.1 Ground-water recharge																							n	n	s	s	n	n	n	n	n	n	n	s	s	s	n	n	n	s
6.2 Physical Features																								s	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
6.3 Vegetation																									n	s	s	n	n	n	n	s	n	n	s	s	n	n	n	n
6.4 Rainfall/runoff mgmt																										s	s	s	n	s	n	n	n	n	s	s	n	n	s	s
6.5 Pollution Reduction																											n	s	n	n	n	n	n	n	s	n	n	n	n	s
6.6 Flow Regime																												n	n	n	n	n	n	n	n	n	n	n	s	n
7.1 Mutual Local Goals																													s	s	s	s	s	s	s	s	s	s	s	s
7.2 Supports General Plan																														s	s	s	s	s	n	n	n	n	n	n
8.1 Safe Access																															s	n	s	n	n	n	s	n	n	n
8.2 Recreation																																n	s	s	n	s	s	c	n	s
8.3 Aesthetics																																	n	s	s	s	s	n	n	n
8.4 Social and Cultural																																		s	s	n	s	n	n	s
8.5 Economic Effects																																			n	n	s	n	n	s
8.6 Green Methods																																				s	s	n	s	s
8.7 Open Space																																					n	c	s	s
8.8 Community Input																																								
9.1 Capital Cost																																							c	s
9.2 Maintenance/Operation																																								n
9.3 Grants/Cost-Shares																																								

Legend

s	=	Mutually Supportive Criteria	(46% of combinations)
n	=	Mutually Neutral Criteria	(52% of combinations)
c	=	Conflicting Criteria	(3% of combinations)